US008217951B2

(12) **United States Patent**
Jung

(10) **Patent No.: US 8,217,951 B2**
(45) **Date of Patent: Jul. 10, 2012**

(54) **GRAPHIC DATA PROCESSING APPARATUS AND METHOD**

(75) Inventor: **Chang Kwon Jung**, Seoul-si (KR)

(73) Assignee: **LG Electronics Inc.**, Seoul (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 894 days.

(21) Appl. No.: **12/052,488**

(22) Filed: **Mar. 20, 2008**

(65) **Prior Publication Data**

US 2009/0027403 A1 Jan. 29, 2009

(30) **Foreign Application Priority Data**

Jul. 26, 2007 (KR) 10-2007-0075273

(51) **Int. Cl.**
G06F 15/80 (2006.01)
G06F 15/16 (2006.01)

(52) **U.S. Cl.** **345/505**; 345/502

(58) **Field of Classification Search** 345/502–505
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,774,668 A * 6/1998 Choquier et al. 709/223
6,618,042 B1 * 9/2003 Powell 345/204
2002/0026560 A1 * 2/2002 Jordan et al. 711/120
2006/0047751 A1 * 3/2006 Chen et al. 709/205
2006/0061578 A1 3/2006 Washizu
2006/0267993 A1 * 11/2006 Hunkins et al. 345/502
2007/0018990 A1 * 1/2007 Shreiner 345/505
2007/0294512 A1 * 12/2007 Crutchfield et al. 712/200
2008/0276261 A1 * 11/2008 Munshi et al. 719/328

FOREIGN PATENT DOCUMENTS

CN 1330350 A 1/2002
CN 1431629 A 7/2003
CN 1753026 A 3/2006

* cited by examiner

Primary Examiner — Xiao M. Wu
Assistant Examiner — Yingchun He
(74) *Attorney, Agent, or Firm* — Birch, Stewart, Kolasch & Birch, LLP

(57) **ABSTRACT**

The present invention relates to an apparatus and method for processing graphic data. According to an embodiment, the graphic data processing apparatus includes a CPU having at least one core; a GPU configured to process graphic data; a usage level checking unit configured to check a usage level of the CPU and/or a usage level of the GPU; and a control unit configured to compare the checked usage level of the CPU with a usage level reference of the CPU and/or to compare the checked usage level of the GPU with a usage level reference of the GPU, to allow the graphic data to be processed in parallel by the CPU and the GPU or only by the GPU according to the comparison results.

4 Claims, 6 Drawing Sheets

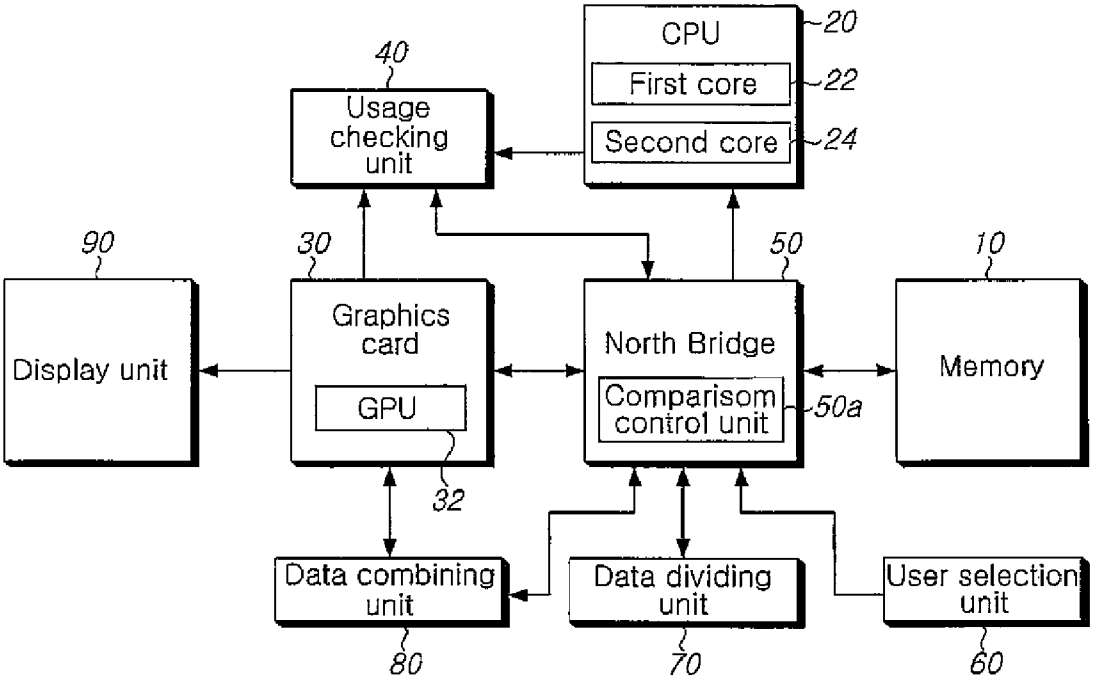


FIG. 1A

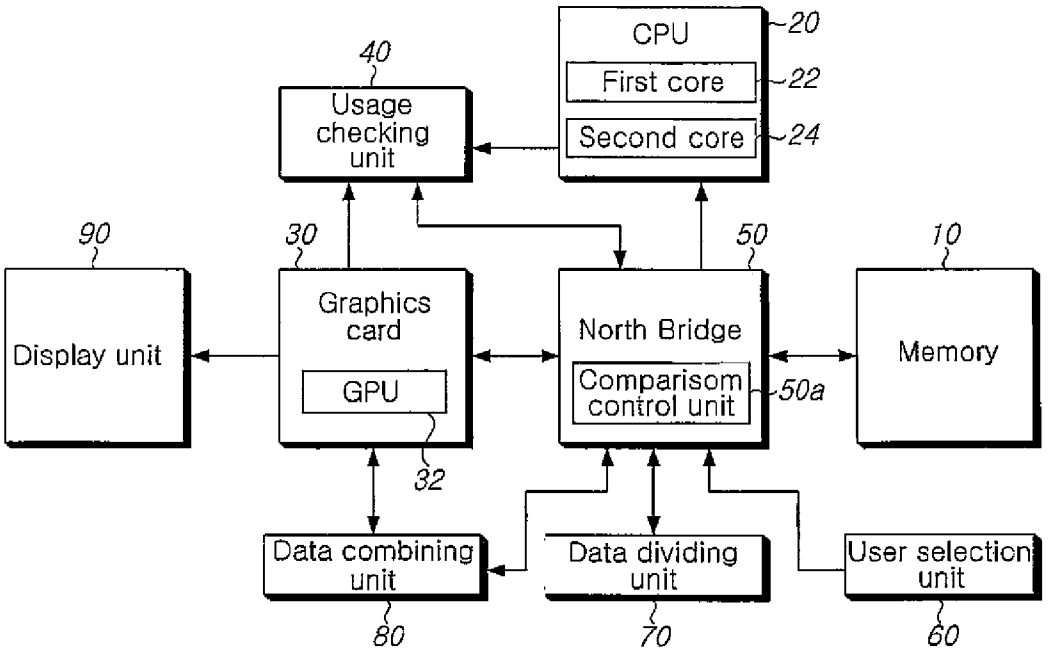

CPU
20
First core
22
Second core
24
40
Usage checking unit
90
30
50
10
Display unit
Graphics card
GPU
32
North Bridge
Comparisom control unit
50a
Memory
Data combining unit
80
Data dividing unit
70
User selection unit
60

FIG.1B

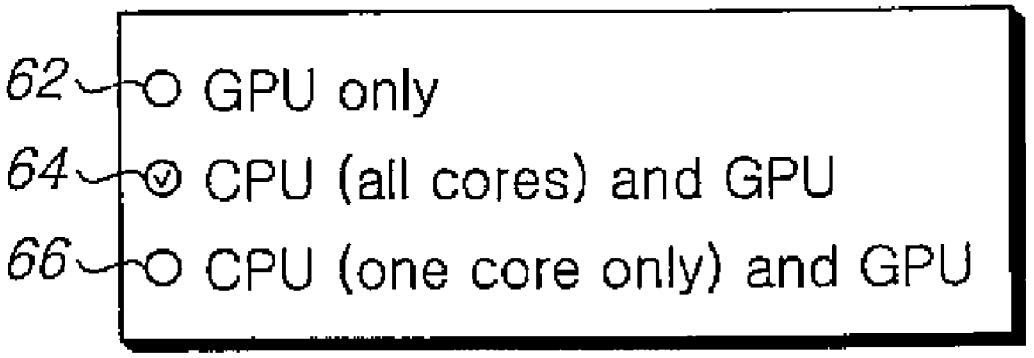

62
GPU only
64
CPU (all cores) and GPU
66
CPU (one core only) and GPU

FIG.2

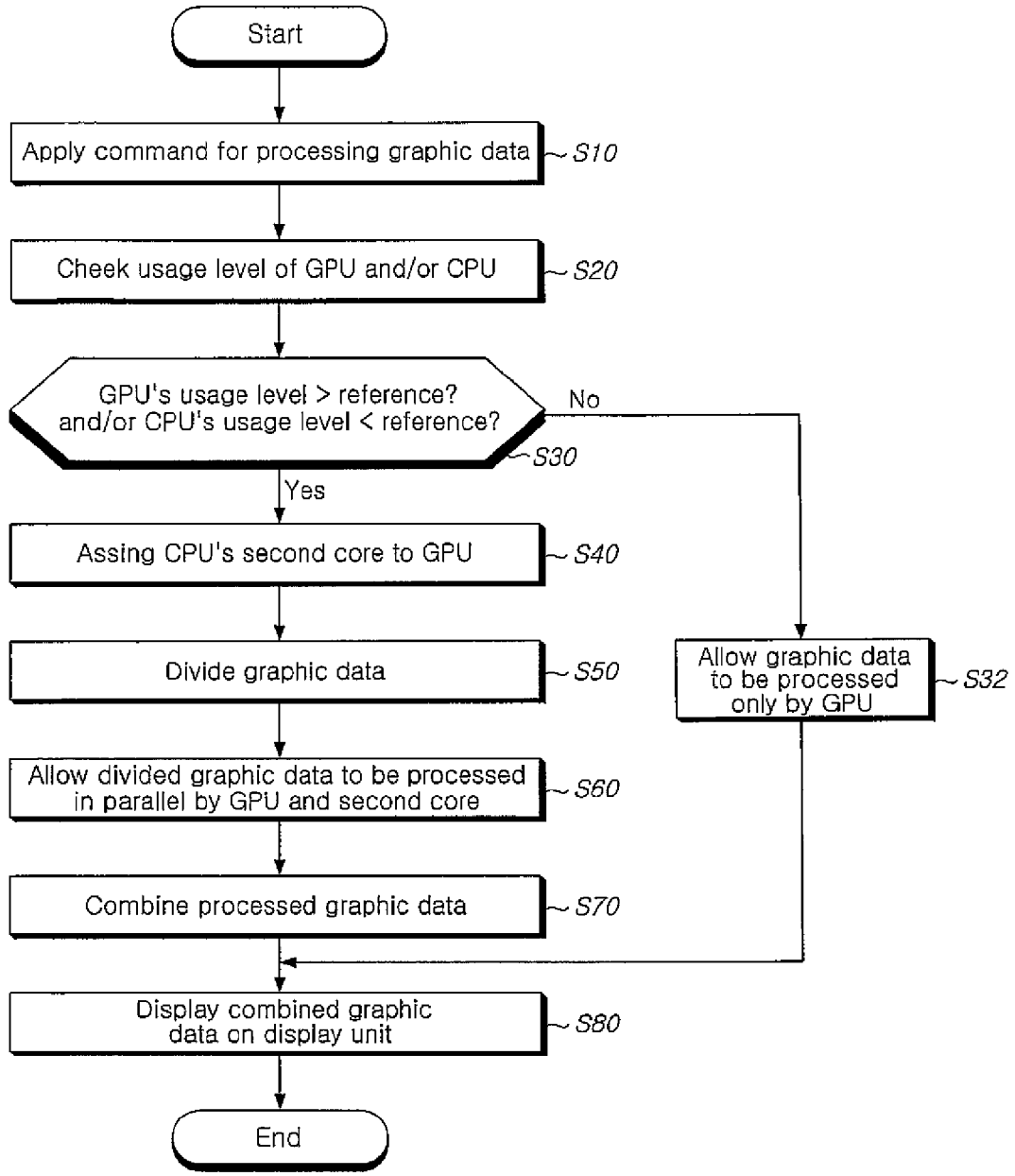

Start
Apply command for processing graphic data
S10
Cheek usage level of GPU and/or CPU
S20
GPU's usage level > reference?
and/or CPU's usage level < reference?
S30
No
Yes
Assing CPU's second core to GPU
S40
Divide graphic data
S50
Allow divided graphic data to be processed in parallel by GPU and second core
S60
Combine processed graphic data
S70
Allow graphic data to be processed only by GPU
S32
Display combined graphic data on display unit
S80
End

FIG. 3A

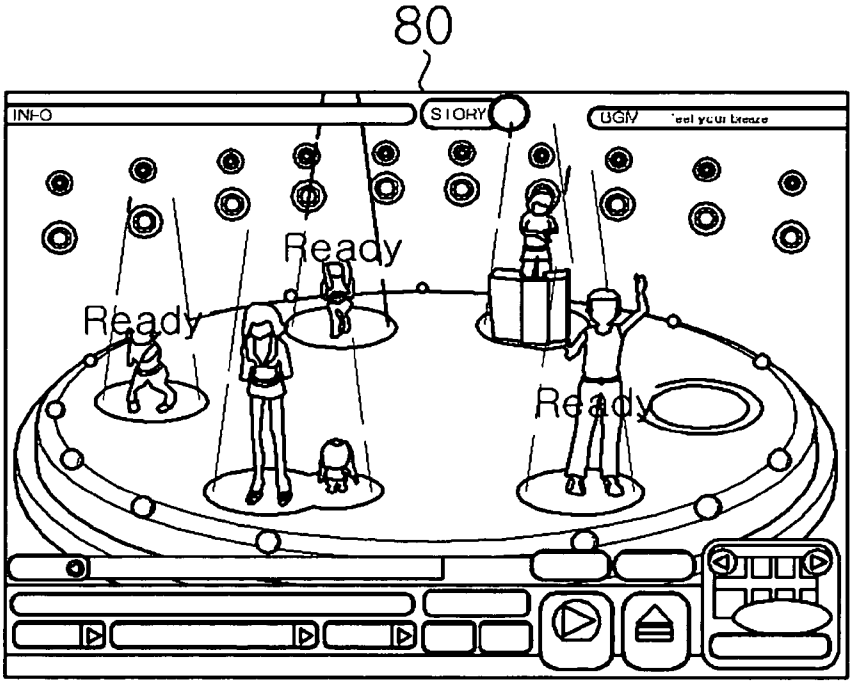


FIG. 3B

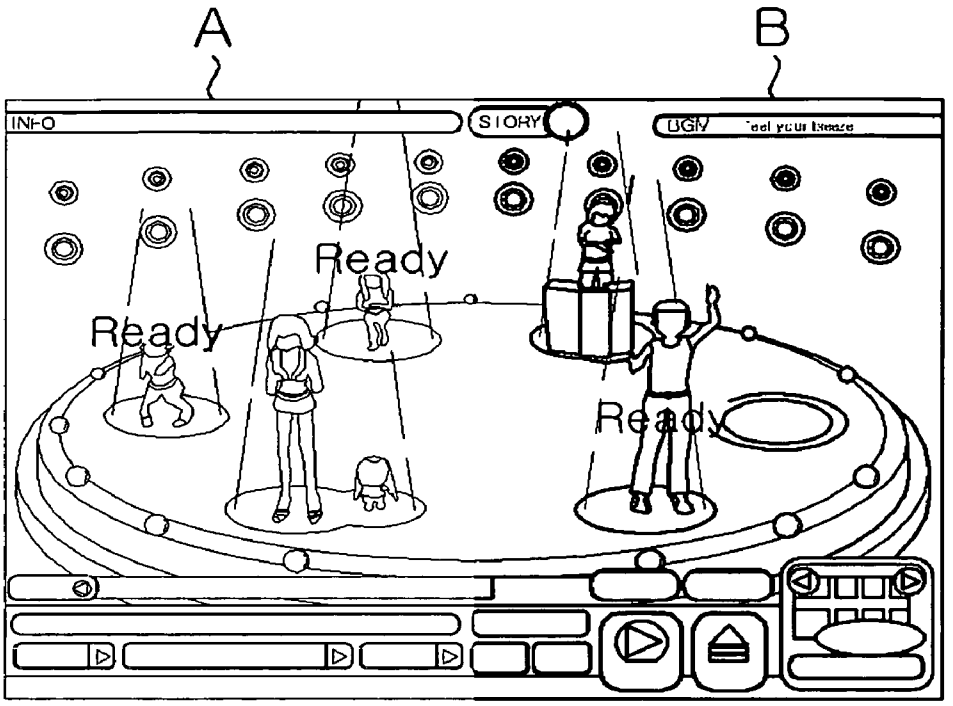
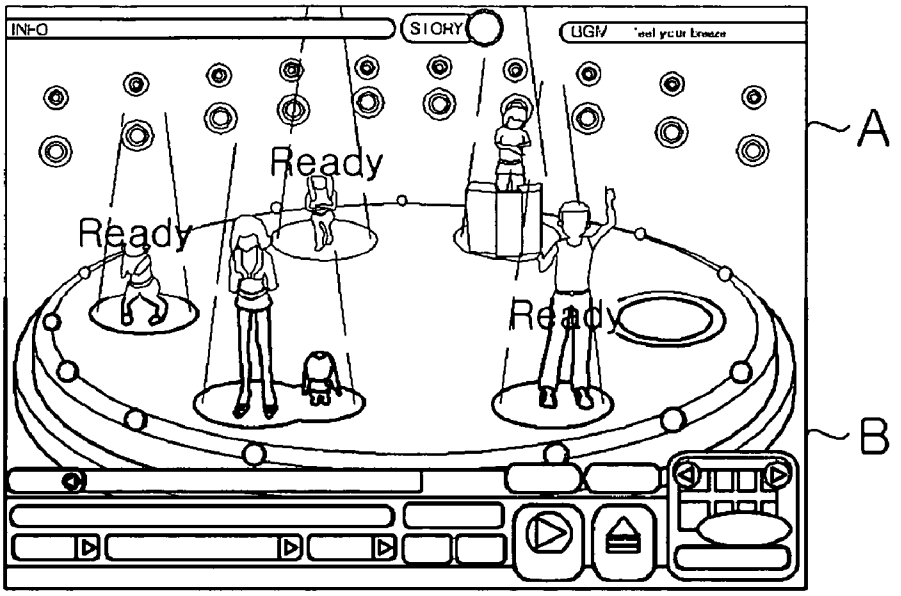


FIG. 3C



GRAPHIC DATA PROCESSING APPARATUS AND METHOD

This nonprovisional application claims the priority benefit of Korean Application No. 10-2007-0075273 filed on Jul. 26, 2007, the entirety of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to graphic data processing, and more particularly, to an apparatus and method for processing graphic data, wherein the usage levels of a graphics processing unit (GPU) and a central processing unit (CPU) are checked to allow graphic data to be processed either only by the GPU or in parallel by both the GPU and the CPU.

2. Description of the Related Art

Generally, a graphics card, which is also called a video card, a video display card, a video controller or the like, serves to convert digital information generated by a personal computer (PC) system into analog signals and to transmit the analog signals to a display unit.

Recently, as functions of a graphics card are extended from two-dimensional (2D) to three-dimensional (3D) graphic processing, the importance of the graphics card in the PC system is further increased.

However, the performance of the graphics card is determined in accordance with a graphics processing unit (hereinafter, referred to as a "GPU"). Therefore, if an amount of data to be processed by the GPU is large and the GPU is overloaded, the processing rate of the graphics card is reduced.

Accordingly, even though a PC system is capable of providing excellent performance, there is a problem in that if the processing is delayed due to the overloading of the GPU, the performance of the PC system may be degraded.

SUMMARY OF THE INVENTION

The present invention is conceived to address the aforementioned problems and limitations associated with the related art. Accordingly, an object of the present invention is to provide an apparatus and method for processing graphic data, wherein use rates (or usage) of a GPU and a CPU are checked to allow the graphic data to be processed only by the GPU or in parallel by the GPU and the CPU.

According to an aspect of the present invention, there is provided a graphic data processing apparatus, which comprises a dual core CPU; a GPU for processing graphic data; a processing amount check unit for checking processing amounts of the CPU and the GPU; and a control unit for comparing the checked processing amounts of the CPU and the GPU with reference processing amounts of the CPU and the GPU, respectively, to allow the graphic data to be processed in parallel by the CPU and the GPU or only by the GPU according to the result of the comparison.

The control unit may control processing the graphic data only by the GPU if it is determined from the comparison that the processing amount of the GPU is smaller (or not larger) than the reference processing amount of the GPU and/or the processing amount of the CPU is larger (or not smaller) than the reference processing amount of the CPU.

The control unit may control processing the graphic data in parallel by the GPU and the CPU if it is determined from the comparison that the processing amount of the GPU is larger than the reference processing amount of the GPU and/or the processing amount of the CPU is also smaller than the reference processing amount of the CPU.

The graphic data processing apparatus may further comprise a data dividing unit for receiving the graphic data from the control unit and dividing the received graphic data; and a data combining unit for combining, after the GPU and the CPU have processed the divided graphic data, the processed graphic data to display the combined graphic data on a display unit such as a monitor.

The control unit may transfer the graphic data processed by the CPU to the data combining unit.

The graphic data processing apparatus may further comprise a user selection unit for allowing a user to manually select whether to process the graphic data only by the GPU or in parallel by the GPU and the CPU.

The control unit may control one of the cores of the dual core CPU to process system data and another core to be assigned to the GPU for processing the graphic data, in accordance with the processing amounts (e.g., usage levels) of the GPU and the CPU provided by the processing amount check unit.

The processing amounts may be use rates for processing the graphic data or system data.

According to another aspect of the present invention, there is provided a method of processing graphic data, which comprises the steps of applying a command for processing graphic data; checking processing amounts of a GPU and a CPU in response to the applied command; comparing the checked processing amounts of the GPU and the CPU with reference processing amounts of the GPU and the CPU, respectively; and controlling the graphic data to be processed in parallel by the GPU and the CPU or only by the GPU according to the result of the comparison.

The controlling step may comprise the step of allowing the graphic data to be processed only by the GPU, if it is determined in the comparison that the processing amount of the GPU is smaller than the reference processing amount of the GPU and/or the processing amount of the CPU is larger than the reference processing amount of the CPU.

The controlling step may comprise the step of allowing the graphic data to be processed in parallel by the GPU and the CPU, if it is determined in the comparison that the processing amount of the GPU is larger than the reference processing amount of the GPU and/or the processing amount of the CPU is smaller than the reference processing amount of the CPU.

The controlling step may comprise the steps of assigning one of cores of the CPU to process the graphic data; dividing the graphic data to allow the divided graphic data to be processed in parallel by the assigned core and the GPU; and combining the divided graphic data to allow the combined graphic data to be displayed as a frame on a monitor.

The dividing step may comprise the step of dividing graphic data according to split areas on an entire screen of the monitor.

The combining step may comprise the step of allowing the graphic data processed by the assigned core to be transferred through the control unit and the graphic data processed by the GPU to be transferred through the GPU, respectively, in synchronization with each other.

According to the present invention, there is an advantage in that use rates of the GPU and the CPU are checked to allow graphic data to be processed only by the GPU or in parallel by the GPU and the CPU according to the checked use rates.

According to an embodiment, the present invention provides a graphic data processing apparatus, comprising: a CPU having at least one core; a GPU configured to process graphic data; a usage level checking unit configured to check a usage

level of the CPU and/or a usage level of the GPU; and a control unit configured to compare the checked usage level of the CPU with a usage level reference of the CPU and/or to compare the checked usage level of the GPU with a usage level reference of the GPU, to allow the graphic data to be processed in parallel by the CPU and the GPU or only by the GPU according to the comparison results.

According to an embodiment, the present invention provides a data processing apparatus, comprising: a dual core CPU; a GPU configured to process graphic data; a usage level checking unit configured to check a usage level of the CPU and a usage level of the GPU; and a control unit configured to control one core of the dual core CPU to process system data and another core of the dual core CPU to be assigned to the GPU for processing the graphic data, in accordance with the checked usage levels of the GPU and the CPU provided by the usage level checking unit.

According to an embodiment, the present invention provides a method of processing graphic data, comprising: applying a command for processing graphic data; checking a usage level of a GPU and/or a usage level of a CPU in response to the applied command; comparing the checked usage level of the GPU with a usage level reference of the GPU and/or the checked usage level of the CPU with a usage level reference of the CPU; and controlling at least one of the GPU and the CPU to allow the graphic data to be processed in parallel by the GPU and the CPU or only by the GPU according to the comparison results.

According to another embodiment, the present invention provides a method of processing graphic data, comprising: applying a command for processing graphic data; checking a usage level of a GPU and/or a usage level of a CPU in response to the applied command; comparing the checked usage level of the GPU with a usage level reference of the GPU and/or the checked usage level of the CPU with a usage level reference of the CPU; assigning one of cores of the CPU to process the graphic data based on the comparison results; dividing the graphic data to allow the divided graphic data to be processed in parallel by the assigned core of the CPU and the GPU; and combining the divided graphic data to allow the combined graphic data to be displayed on a display unit.

These and other objects of the present application will become more readily apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become apparent from the following descriptions of preferred embodiments given in conjunction with the accompanying drawings, in which:

FIG. **1**A is a view showing an example of the configuration of a graphic data processing apparatus according to a preferred embodiment of the present invention;

FIG. **1**B is an example of a menu displayable for a user's selection of a use of a GPU and/or a CPU according to an embodiment of the present invention;

FIG. **2** is a flowchart illustrating a graphic data processing method according to a preferred embodiment of the present invention; and

FIGS. **3**A to **3**C are views showing an example in which a screen is split to divide graphic data to be processed into certain areas according to an embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, a graphic data processing apparatus according to the preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings.

Referring to FIG. **1**A, the graphic data processing apparatus according to an embodiment comprises a central processing unit (CPU) **20** configured to access a memory **10** (or other storage unit) to execute a variety of application programs and to apply a command for processing graphic data relevant to the application programs. The CPU **20** is preferably a dual core CPU including a first core **22** and a second core **24**, but can of other type. As an example, one of the first and second cores **22** and **24** processes system data, while the other of the first and second cores **22** and **24** processes graphic data under the control of a North Bridge **50** that will be described below. Here, the second core **24** may be assigned to process graphic data.

The graphic data processing apparatus further comprises a graphics card **30** for receiving the graphic data through the North Bridge **50** in accordance with the command applied by the CPU **20** and converting the graphic data into image signals to display the graphic data on a display unit **90**.

The graphics card **30** is provided with a graphics processing unit (GPU) **32** for processing the received graphic data. As an alternative, the GPU **32** can be part of the North Bridge **50** on a single chip.

In addition, the graphic data processing apparatus further comprises a usage checking unit **40** (or processing amount checking unit) for checking the resource use rates (i.e., the usage levels) of the CPU **20** and the GPU **32**. The usage levels of the CPU **20** and the GPU **32** represent how much or what percentage of the CPU **20** and GPU **32** has been used or involved in processing data, and may also be referred to herein as "processing amounts" of the CPU **20** and the GPU **32**. Here, it is preferred that a real time assessment of the usage levels of the CPU **20** and GPU **32** is made by the usage checking unit **40** and such assessment may be performed at regular intervals, continuously or at a desired time. As an example, the usage checking unit **40** can be a task manager of Windows provided by Microsoft Corporation and a driver corresponding to the graphics card **30**. The usage of the CPU **20** and/or GPU **32** may be measured or determined by measuring an idle tread value of the CPU **20** and/or GPU **32** for a predetermined period of time or by detecting the CPU/GPU usage from the registry information of the computer system.

The graphic data processing apparatus further comprises the North Bridge **50** which includes a comparison control unit **50***a* for comparing, if the usage levels of the GPU **32** and the CPU **20** checked by the usage checking unit **40** are provided, the provided usage levels of the GPU **32** and the CPU **20** with a predetermined usage level reference of the GPU **32** (hereinafter also referred to as a "first reference") and a predetermined usage level reference of the CPU **20** (hereinafter also referred to as a "second reference"), respectively. According to a preferred embodiment, if the comparison control unit **50***a* determined that the provided usage level of the GPU **32** is smaller than (or not larger than) the first reference and the provided usage level of the CPU **20** is larger than (or not smaller than) the second reference, the comparison control

unit **50***a* controls the GPU **32** so that the graphic data are processed only by the GPU **32**. On the contrary, if it is determined that the provided usage level of the GPU **32** is larger than the first reference amount and the provided processing amount of the CPU **20** is smaller than the second reference, the comparison control unit **50***a* controls so that the graphic data are processed in parallel by both the second core **24** and the GPU **32**.

That is, the comparison control unit **50***a* assigns the second core **24** of the CPU **20** to perform a function of the GPU, and thus, the graphic data are processed in parallel by the second core **24** and the GPU **32**. The comparison control unit **50***a* can be part of the North Bridge **50** or can reside in other components of the system.

In addition, when the second core **24** and the GPU **32** are to process the graphic data in parallel under the control of the comparison control unit **50***a*, the comparison control unit **50***a* (or the North Bridge **50**) transfers the graphic data to be processed to a data dividing unit **70** (hereinafter, referred to as a "dividing unit") which in turn can divide the graphic data and forward the divided graphic data respectively to the second core **24** and the GPU **32** for processing. In addition, the North Bridge **50** (or the comparison control unit **50***a*) transfers the graphic data processed by the second core **24** and/or the graphic data processed by the GPU **32** to a data combining unit **80** (hereinafter, referred to as a "combining unit") so that they may be combined as desired.

For example, once the graphic data to be processed are received through the North Bridge **50**, the dividing unit **70** divides the received graphic data. For instance, the graphic data are divided to partition each frame into two predetermined areas such that the graphic data contained in the partitioned areas can be processed in parallel respectively by the second core **24** and the GPU **32**.

If the graphic data processed respectively by the second core **24** and the GPU **32** are transferred, the combining unit **80** combines the transferred graphic data.

The North Bridge **50**, the combining unit **80** and the dividing unit **70** can be integrated into one component. Further, all the components of the graphic data processing apparatus are operatively coupled and configured.

In addition, the graphic data processing apparatus further comprises a user selection unit **60** for allowing a user to manually select whether to process the graphic data only by the GPU **32** or in parallel by both the second core **24** and the GPU **32**. For example, the user selection unit **60** provides a graphical display menu on the display unit **90**, which can be implemented by a user selection program installed in the user selection unit **60**, so that the user can make a selection of desired processor. Buttons, keys, etc. can also be provided to such user's manual selection. For instance, as shown in FIG. **1**B, a menu provides three different choices or modes (**62**, **64**, **66**) for a user, wherein the first choice **62** is for allowing only the GPU to process the data, the second choice **64** is for allowing both the CPU (all cores such as first and second cores, etc. of the CPU) and the GPU to process the data, and the third choice **66** is for allowing certain cores of the CPU (e.g., only one core such as the second core **24** of the CPU) and the GPU to process the data. Other examples are possible. As an alternative, it is automatically determined whether the graphic data are processed only by the GPU **32** or in parallel by the GPU **32** and the CPU **20** depending on the determined current usage levels of the GPU **32** and the CPU **20**.

Hereinafter, a method of processing graphic data according to a preferred embodiment of the present invention will be described in detail with reference to FIGS. **2** and **3**. This method is implemented in the apparatus of FIG. **1** but can be implemented in other suitable system.

First, referring to FIG. **2**, the CPU **20** accesses the memory **10** to perform a specific operating process in accordance with an application program execution command and provides the North Bridge **50** with a graphic data processing command corresponding to the operating process (step S**10**).

Then, the comparison control unit **50***a* transfers the graphic data to the graphics card **30**.

If the graphic data are transferred to the graphics card **30**, the usage level checking unit **40** checks processing amounts (usage levels) of the GPU **32** and the CPU **20** that are currently being driven and continuously sends the checked usage levels of the GPU **32** and the CPU **20** to the comparison control unit **50***a* (step S**20**). For instance, how much (e.g., what percentage) of the total processing capacity of the GPU **32** and the CPU **20** is currently being used can be determined by the usage checking unit **40**.

Accordingly, the comparison control unit **50***a* compares the checked usage levels of the GPU **32** and the CPU **20** with a predetermined first usage level reference and a second usage level reference, respectively (step S**30**). In one embodiment, at step S**30** if it is determined that the GPU's current usage level is greater than the first usage level reference and that the CPU's current usage level is less than the second usage level reference, then the method proceeds to step S**40** or otherwise to step S**32**. In another embodiment, at step S**30** if it is determined either that the GPU's current usage level is greater than the first usage level reference or that the CPU's current usage level is less than the second usage level reference, then the method can proceed to step S**40**. If not, the method proceeds to step S**32**.

Here, the predetermined usage level references may be set by a user or arbitrarily set to default values. Further, one or more reference values may be used to compare with each of the current usage levels of the GPU **32** and the CPU **20**. For instance, two values (50% and 75%) can be used as references. In such an example, if the GPU **32**'s current usage level is at or above 75%, then the method may proceed to step S**40**. If the GPU's current usage level is between 50% and 75%, then the current mode of the system is maintained (the mode is not switched to a different mode). If the GPU's current usage level is below 50%, then the method may proceed to step S**32**.

If it is determined in step S**30** that the usage level of the GPU **32** is larger than the first reference and (in another example, "or") the usage level of the CPU **20** is also smaller than the second reference, the comparison control unit **50***a* assigns the second core **24** to perform a function of the GPU (step S**40**). At this time, since the comparison control unit **50***a* assigns the second core **24** to perform a function of the GPU, the first core **22** of the CPU **20** processes system data, and the second core **24** and the GPU **32** process the graphic data in parallel.

Then, since the second core **24** is assigned to process the graphic data, the comparison control unit **50***a* transfers the graphic data to the dividing unit **70**.

If the graphic data are transferred by the comparison control unit **50***a*, the dividing unit **70** divides the graphic data into parts to be processed respectively by the second core **24** and the GPU **32** (step S**50**). Here, the graphic data are divided in order to partition each frame into two predetermined areas such that the graphic data contained in the partitioned areas can be processed by the second core **24** and the GPU **32**, respectively.

For example, FIGS. **3**A to **3**C are views illustrating an example of a screen divided into two partitions for processing

graphic data. Referring to FIG. **3**A to **3**C, the dividing unit **70** divides the graphic data such that the entire screen (FIG. **3**A) of the display unit **90** can be split into two areas in a horizontal direction (FIG. **3**B) or vertical direction (FIG. **3**C). The graphic data are divided in such a manner that graphic data in an area A of the split areas are processed by the second core **24** and graphic data in an area B of the split areas are processed by the GPU **32**. This method is the same as the split frame rendering (SFR) among the methods of rendering a screen in the scalable link interface (SLI) of Gforce.

Returning to FIG. **2**, the graphic data divided by the dividing unit **70** in step S**50** are transferred to the second core **24** and the GPU **32**, respectively, through the comparison control unit **50***a* or the North Bridge **50**.

Then, the second core **24** and the GPU **32** respectively process the transferred divided graphic data in parallel (step S**60**).

The graphic data processed by the second core **24** are transferred to the combining unit **80** through the comparison control unit **50***a* (or the North Bridge **50**), and the graphic data processed by the GPU **32** are transferred to the combining unit **80** through the GPU **32**. At this time, the second core **24** and the GPU **32** output the graphic data in synchronization with each other.

The combining unit **80** that has received the outputted graphic data combines the graphic data such that the combined graphic data can be displayed as a full screen on the display unit **90** (step S**70**). If the graphics card has a bandwidth of a 16x speed slot, the combining unit **80** receives graphic data through a bandwidth of an 8x speed slot and then combines the received graphic data.

The combined graphic data are displayed on the display unit **90** through the graphics card **30** (step S**80**).

On the other hand, if it is determined in step S**30** that the current usage level of the GPU **32** is not larger than the first usage level reference and/or the current usage level of the CPU **20** is not smaller than the second usage level reference, the comparison control unit **50***a* controls so that the graphic data are processed only by the GPU **32** (step S**32**).

According to an embodiment, in the example of FIG. **1**A, the user can select an appropriate mode according the amount of processing needs. Various modes can be available to the user. For instance, the mode **64** may be a graphics mode for movies, games, etc. Further, while the GPU and/or CPU is running, the comparison control unit **50***a* can receive current battery information (e.g., from OS) and automatically switch to an appropriate mode (e.g., one of the modes **62**, **64**, **66**) depending on the battery information. In this manner, the system is able to check the current battery level and override the user-selected mode (**62**, **64** or **66**) if needed. For instance, if the user selected the mode **66** and the current battery level is detected to be below 50%, then the system may switch the mode to the mode **62**. Other variations are possible. For example, two or more thresholds can be used to switch between the modes **62**, **64** and **66**. Also anytime the mode switch is made due to the user's selection or system's selection, the user may be notified of the mode switch and/or the new mode of the system. Such notification can be made visually and/or audibly through the apparatus of FIG. **1**A.

The present invention described in the aforementioned embodiments is advantageous in that since use rates of the GPU and the CPU are checked to allow graphic data to be processed only by the GPU or in parallel by the GPU and the CPU or parts thereof, the GPU is not overloaded.

According to a graphic data processing apparatus and method of the present invention as described above, there still is an advantage in that use rates of the GPU and the CPU are checked to allow graphic data to be processed only by the GPU or in parallel by the GPU and the CPU (or parts thereof) depending on the checked use rates.

Further, if the GPU and the CPU are allowed to process graphic data in parallel, the performance of two graphics cards is improved and thus, the cost and volume reduction can be made.

While the present invention has been illustrated and described in connection with the accompanying drawings and the preferred embodiments, the present invention is not limited thereto and is defined by the appended claims. Therefore, it will be understood by those skilled in the art that various modifications and changes can be made thereto without departing from the spirit and scope of the invention defined by the appended claims.

What is claimed is:

1. A graphic data processing apparatus, comprising:

a CPU having at least two cores;

a GPU configured to process graphic data;

a usage level checking unit configured to check a usage level of the CPU and a usage level of the GPU;

a control unit configured to compare the checked usage level of the CPU with a usage level reference of the CPU and to compare the checked usage level of the GPU with a usage level reference of the GPU, and to control one core of the CPU to process system data and another core of the CPU to be assigned to the GPU for processing the graphic data in accordance with the checked usage levels of the GPU and the CPU provided by the usage level checking unit,

wherein the control unit allows processing of the graphic data only by the GPU if the control unit determines that the checked usage level of the GPU is not larger than the usage level reference of the GPU and/or the checked usage level of the CPU is not smaller than the usage level reference of the CPU, and

wherein the control unit allows processing of the graphic data in parallel by the GPU and the assigned core of the CPU if the control units determines that the checked usage level of the GPU is larger than the usage level reference of the GPU and, at the same time, the checked usage level of the CPU is smaller than the usage level reference of the CPU;

a data dividing unit configured to receive the graphic data from the control unit and to divide the received graphic data when the control unit allows processing of the graphic data in parallel by the GPU and the assigned core of the CPU;

a data combining unit configured to combine, after the GPU and the assigned core of the CPU have respectively processed the divided graphic data by the data dividing unit, the processed graphic data to display the combined graphic data on a display unit; and

a user selection unit configured to allow a user to manually select whether to process the graphic data only by the GPU or in parallel by the GPU and the assigned core of the CPU,

wherein the manual selection of the user made through the user selection unit is overridden by the control unit based on current battery information associated with the apparatus.

2. The apparatus as claimed in claim **1**, wherein the control unit transfers the graphic data processed by the assigned core of the CPU to the data combining unit.

3. The apparatus as claimed in claim **1**, wherein the usage levels are use rates for processing the graphic data or system data.

4. A method of processing graphic data, comprising:
applying a command for processing graphic data;
checking a usage level of a GPU and a usage level of a CPU in response to the applied command, the CPU having at least two cores;
comparing the checked usage level of the GPU with a usage level reference of the GPU and the checked usage level of the CPU with a usage level reference of the CPU to develop a comparison result;
controlling at least one of the GPU and one core of the CPU to allow the graphic data to be processed in parallel by the GPU and the one core of the CPU or only by the GPU according to the comparison results,
wherein the controlling step allows the graphic data to be processed only by the GPU if it is determined that the checked usage level of the GPU is not larger than the usage level reference of the GPU and/or the checked usage level of the CPU is not smaller than the usage level reference of the CPU,
wherein the controlling step allows the graphic data to be processed in parallel by the GPU and the one core of the CPU if it is determined that the checked usage level of the GPU is larger than the usage level reference of the GPU and, at the same time, the checked usage level of the CPU is smaller than the usage level reference of the CPU;
assigning the one core of the CPU to process the graphic data based on the comparison result;
dividing the graphic data to allow the divided graphic data to be processed in parallel by the assigned core of the CPU and the GPU;
combining the divided graphic data to allow the combined graphic data to be displayed on a display unit;
receiving a user's manual selection on whether to process the graphic data only by the GPU or in parallel by the GPU and the CPU; and
controlling at least one of the GPU and the CPU based on the user's manual selection,
wherein the user's manual selection is overridden based on current battery information.

* * * * *